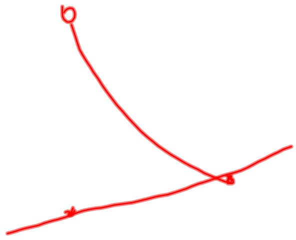
1) For each graph draw the secant line through the two points on the graph corresponding to the endpoints of the interval.

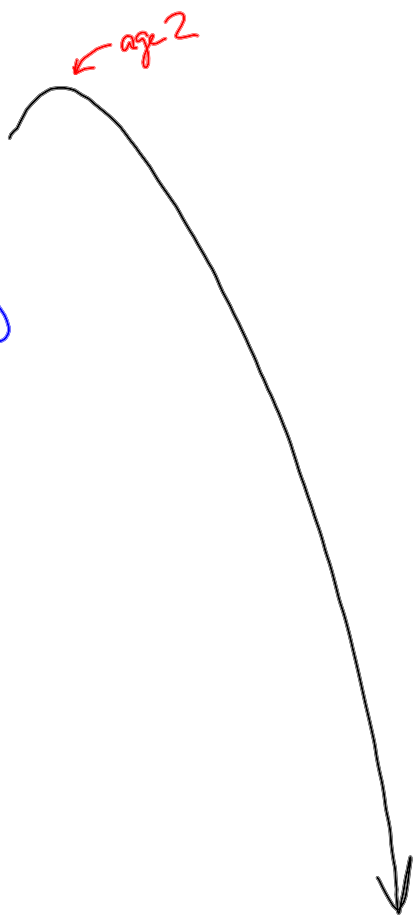
2) On the indicated interval, draw any tangent lines to the graph of the function that are parallel to the secant line you drew in part 1.

3) For each tangent line, estimate the *x*-value of the point of tangency.

2ND handout #2

$x \approx 1.5$





$$\frac{d\left(\text{boys' IQ}\right)}{dt} = -\infty$$

MVT

$y = -(x-0)(x-4)$

If $f(x)$ is

* continuous on $[a,b]$
* differentiable on (a,b)

Then

$$\exists\, c \in (a,b) \ni f'(c) = \frac{f(b)-f(a)}{b-a}$$

there exists   "cee" "see?" "see!" "si!"   "in the interval"   "such that"   "equals"

Handout 3 $g(x) = 4x^3 - x^2 + 4$ on $[-1, 1]$

\#1

$g(1) = 4 - 1 + 4 = 7$

$g(-1) = -4 - 1 + 4 = -1$

$m_{\text{secant line}} = \frac{7-(-1)}{1-(-1)} = \frac{8}{2} = 4$

Where is my guaranteed c?

$g'(x) = 12x^2 - 2x$

solve $12x^2 - 2x = 4$

$2(6x^2 - x - 2) = 0$

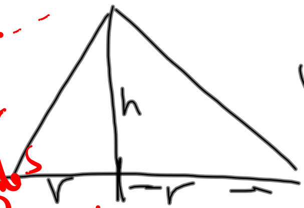
$2\left((3x-2)(2x+1)\right) = 0$

$x = \frac{2}{3}, -\frac{1}{2}$

3.7/26 altitude = twice radius i.e. $h = 2r$

$8 \ \frac{ft^3}{min}$

important cone idea...
use similar triangles to get relationship between h & r



$V_{cone} = \frac{\pi}{3} r^2 h$

$V_{cone} = \frac{\pi}{3} r^2 (2r)$

(2) $= \frac{2\pi}{3} r^3$

(3) $\frac{dV}{dt} = 2\pi r^2 \frac{dr}{dt}$

when

$h = 6 \text{ ft}$

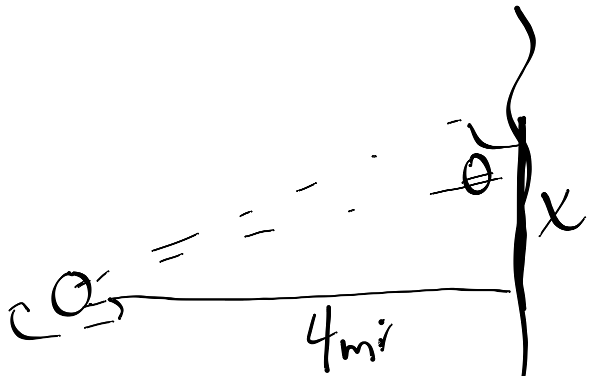
$r = \frac{6}{2} = 3 \text{ft}$

$\frac{dV}{dt} = 2\pi (3)^2 \frac{dr}{dt}$ .... ahh

$8 = 18\pi \frac{dr}{dt}$

$\frac{4}{9\pi} \frac{ft}{min} = \frac{8}{18\pi} = \frac{dr}{dt}$

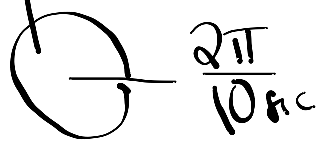
3.7/33)



(2) $\tan\theta = \frac{4}{x} = 4x^{-1}$

(3) $\sec^2\theta \cdot \frac{d\theta}{dt} = -4x^{-2}\frac{dx}{dt}$

(4) what is $\frac{d\theta}{dt}$? - - - - - - - -



what is $\sec^2\theta$? . . . $\sec^2 45^\circ = \frac{1}{\cos^2 45^\circ} = (\sqrt{2})^2 = 2$

What is x? (45°, 4, 4) . . . . . 4 mi

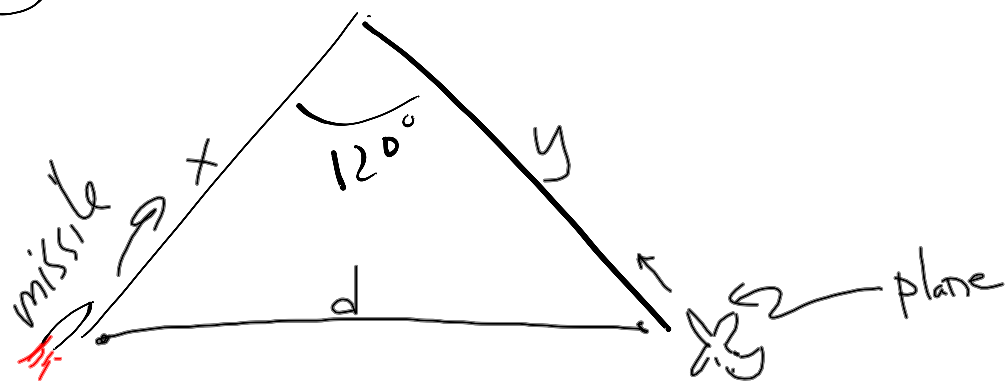
so:

$$2\left(\frac{2\pi}{10}\right) = -\frac{4}{4^2}\cdot\frac{dx}{dt}$$

$$-\frac{16\pi}{10} = -\frac{8\pi}{5} = \frac{dx}{dt}$$

[units = $\frac{mi}{sec}$]

35



$$d^2 = x^2 + y^2 - 2xy \underbrace{\cos 120^\circ}_{\text{doesn't change!}}$$

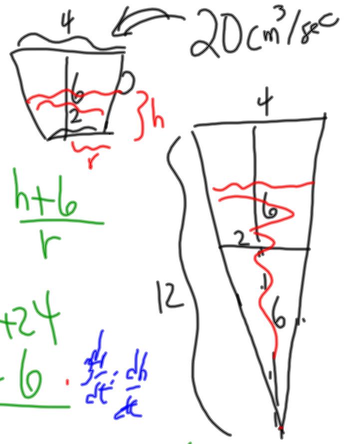
$$d^2 = x^2 + y^2 + 2xy\left(\frac{1}{2}\right)$$

$$2d\frac{dd}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt} + \left[\frac{dx}{dt}y + x\frac{dy}{dt}\right]$$

$$\vdots$$

Seth's B-DAY!

47)



$$\frac{6+6}{4} = \frac{h+6}{r}$$

$$12r = 4h+24$$

$$3r = h+6 \qquad \frac{3\frac{dr}{dt}}{} = \frac{dh}{dt}$$

$$V = \frac{\pi}{3} r^2 \cancel{h} = \frac{\pi}{3} r^2 (3r-6)$$

$$V = \frac{\pi}{3} r^2 (h+6)$$

$$V = \frac{\pi}{3}\left(\frac{h}{3}+2\right)^2 h$$

36 In 2 dimensions

$$d^2 = x^2+y^2$$

In 3 dimensions

$$d^2 = x^2+y^2+z^2$$

$$V = \frac{\pi}{3}\left[\frac{h^3}{4}+\frac{4}{3}h^2+4h\right]$$

$$\frac{dV}{dt} = \frac{\pi}{3}\left(\frac{h^2}{3}+\frac{8}{3}h+4\right)\frac{dh}{dt}$$

$$\frac{60}{\pi} = \left(\frac{h^2}{3}+\frac{8}{3}h+4\right)\frac{dh}{dt}$$

$$\frac{60}{\pi} = \left(\frac{9}{3}+8+4\right)\frac{dh}{dt}$$

$$\frac{\frac{60}{\pi}}{15} = \frac{4}{\pi} = \frac{dh}{dt}$$

$$V = \frac{\pi}{3}\left(\frac{h}{3}+2\right)^2 (h+6)$$

$$V = \frac{\pi}{3}\left[\frac{h^3}{9}+\frac{6h^2}{9}+\frac{4}{3}h^2+\frac{24}{3}h + 4h+24\right]$$

$$V = \frac{\pi}{3}\left[\frac{h^3}{9}+\frac{14h^2}{9}+12h+24\right]$$

37) $\dfrac{xy^3}{1+y^2} = \dfrac{8}{5}$ no pic

deriv...

$$\frac{\frac{d}{dx}(xy^3)\cdot(1+y^2) - (xy^3)\frac{d}{dx}(1+y^2)}{(1+y^2)^2} = 0$$

$$\frac{\left[\left(\frac{dx}{dt}\right)y^3 + (x)\left(3y^2\frac{dy}{dt}\right)\right](1+y^2) - (xy^3)\left(2y\frac{dy}{dt}\right)}{(1+y^2)^2} = 0$$

$$\left(\frac{dx}{dt}y^3 + 3xy^2\frac{dy}{dt}\right)(1+y^2) - 2xy^4\frac{dy}{dt} = 0$$

$\frac{dx}{dt} = 6$ $\rightarrow$ $\left(6\cdot 2^3 + 3(1)(2^2)\frac{dy}{dt}\right)(1+2^2) - 2(1)(2^4)\frac{dy}{dt} = 0$

@ (1,2)

Solve for $\frac{dy}{dt}$